WE CLAIM:

1. A photonic crystal drop filter apparatus, comprising:

a photonic crystal,

a first waveguide in said photonic crystal for transmitting light having a frequency within a bandgap of said photonic crystal;

a second waveguide in said photonic crystal;

a resonant cavity connecting the first and second waveguides for extracting at least one wavelength of the light transmitted in said first waveguide and redirecting the extracted light to said second waveguide; and

a tuning member for controlling the at least one wavelength of the light extracted from said first waveguide.

2. The photonic crystal drop filter apparatus according to Claim 1, wherein said first waveguide extends through said photonic crystal from one side thereof to a second opposite side thereof, and wherein said second waveguide extends from said resonant cavity to a third side of said photonic crystal for transmitting said extracted light out of said apparatus.

3. The photonic crystal drop filter apparatus according to Claim 1, wherein said tuning member comprises a dielectric tuning member in said second waveguide.

4. The photonic crystal drop filter apparatus according to Claim 3, wherein said dielectric tuning member comprises an optical fiber.

5. The photonic crystal drop filter apparatus according to Claim 1, wherein the at least one wavelength of the light extracted from said first waveguide is a function of the position of said tuning member relative to said resonant cavity, and wherein said apparatus further includes a moving device connected to said tuning member for adjusting the position of said tuning member relative to said resonant cavity for extracting a selected at least one wavelength of light from said first waveguide.

6. The photonic crystal drop filter apparatus according to Claim 5, wherein said moving device comprises a micro-mover moving device.

7. The photonic crystal drop filter apparatus according to Claim 1, wherein said photonic crystal comprises a two-dimensional photonic crystal slab having a two-dimensional periodic lattice incorporated in a slab body, and wherein said first waveguide comprises a first line of defects in said two-dimensional periodic lattice extending from a first side to an opposite second side of said two-dimensional photonic crystal slab, and wherein said second waveguide comprises a line of defects in said two-dimensional periodic lattice extending from said resonant cavity to a third side of said two-dimensional photonic crystal slab.

8. The photonic crystal drop filter apparatus according to Claim 7, wherein said periodic lattice comprises an array of posts, and wherein said first waveguide is created by omitting a first line of said posts and said second waveguide is created by omitting a portion of a second line of said posts.

9. The photonic crystal drop filter apparatus according to Claim 8, wherein said array of posts comprises an array of dielectric rods and said slab body comprises air.

10. The photonic crystal drop filter according to Claim 8, wherein said resonant chamber is created by omitting at least one post of said array of posts.

11. An optical communications system, comprising:

A photonic crystal;

a first waveguiding structure in said photonic crystal for transmitting light of a plurality of different wavelengths, each of said plurality of wavelengths of light carrying a different information signal;

a second waveguiding structure in said photonic crystal;

a resonant cavity connecting said first and second waveguiding structures for removing at least one of said plurality of wavelengths of light transmitted by said first waveguiding structure and for redirecting the removed light to said second waveguiding structure; and

a dielectric tuning member for tuning the at least one of said plurality of wavelengths of light removed from said first waveguiding structure.

12. The optical communications system according to Claim 11, wherein said dielectric tuning member comprises a dielectric tuning member in said second waveguiding structure.

13. The optical communications system according to Claim 11, wherein said dielectric tuning member comprises said second waveguiding structure.

14. The optical communications system according to Claim 13, wherein said second waveguiding structure comprises an optical fiber.

15. The optical communications system according to Claim 11, wherein the at least one wavelength of the light removed from said first waveguiding structure is a function of the position of said dielectric tuning member relative to said resonant cavity, and wherein said apparatus further includes a moving device connected to said dielectric tuning member for adjusting the position of said dielectric tuning member relative to said resonant cavity for removing a selected at least one wavelength of light from said first waveguiding structure.

16. The optical communications system according to Claim 15, wherein said moving device comprises a micro-mover moving device.

17. The optical communications system according to Claim 11, wherein said photonic crystal comprises a two-dimensional photonic crystal slab having a two-dimensional periodic lattice incorporated in a slab body, and wherein said first waveguiding structure comprises a first line of defects in said two-dimensional periodic lattice extending from a first side to an opposite second side of said two-dimensional photonic crystal slab, and said second waveguiding structure comprises a line of defects in said two-dimensional periodic lattice extending from said resonant cavity to a third side of said two-dimensional photonic crystal slab.

18. The optical communications system according to Claim 11, wherein said optical communications system comprises a wavelength division multiplexer communications system.

19. In a photonic crystal drop filter comprising a photonic crystal, a first waveguide in said photonic crystal for transmitting light having a frequency within a band gap of said photonic crystal, a second waveguide in said photonic crystal, and a resonant cavity connecting said first and second waveguides for extracting at least one wavelength of the light transmitted by said first waveguide, a method for tuning said photonic crystal drop filter comprising:

selecting a desired at least one wavelength of light to be extracted from said first waveguide; and

positioning a dielectric tuning member with respect to said resonant cavity, the at least one wavelength of light extracted from said first waveguide being a function of the position of said dielectric tuning member with respect to said resonant cavity.

20. The method according to Claim 19, wherein said dielectric tuning member comprises a dielectric tuning member extending into said second waveguide, and wherein the positioning step comprises adjusting the distance of an end of said dielectric tuning member with respect to said resonant cavity.

21. The method according to Claim 19, further including the step of moving said dielectric tuning member to desired positions for tuning said extracted at least one wavelength within a full range of wavelengths.